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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,453	02/26/2004	Koji Matsuyama	FUSA 20.985	9535

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EXAMINER	
LEE, SIU M	
ART UNIT	**PAPER NUMBER**
2611	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 10/790,453	Applicant(s) MATSUYAMA ET AL.	
	Examiner Siu M. Lee	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7 and 13-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *8-12 and 17-20* is/are allowed.

6)☒ Claim(s) *1-7 and 13-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/13/2004*. 2/26/2004
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The spacing of the lines of the specification is such as to make reading difficult. New application papers with lines 1½ or double spaced on good quality paper are required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-7, 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tuukkanen (US 6,584,164 B1) in view of Sano et al. (US 6,381,251 B1)

(1) Regarding claim 1:

Tuukkanen discloses a method in an OFDM wireless system:

receiving, from the transmitting device, frames in which symbols having identical time profiles have been embedded (it is known that the received OFDM signal have a training parts recur after every Nth sample, column 7, lines 31-34);

calculating a correlation value between the identical time profile portions in neighboring frames of a receive signal (the delay block 401 in figure 4 delayed the OFDM signal for N samples wherein N samples can be the length of 1 frame, in the

multiplier 402, the OFDM signal and the complex conjugate of the delayed OFDM signal are multiplied with each other, and N subsequent multiplication results are summed up in a summing block 405, column 7, lines 45-55);

Tuukkanen fails to disclose obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and controlling oscillation frequency based upon said phase.

However, Sano et al. discloses obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device (the oscillation frequency control signal generator 128 in figure 22 take the correlation value from the sweep correlation calculation unit 127 and detect the phase difference between the receiver and the transmitter, column 8, lines 5-20); and controlling oscillation frequency based upon said phase (when the oscillation frequency control signal generator 128 in figure 22 detects when the correlation value is obtained is leading relative to a reference phase which the receiver has, the local oscillator 130 is controlled so as to decrease the oscillation frequency , while when the point of sample where a peak correlation value is obtained is lagging relative to the reference phase of the receiver, it is controlled to increase the oscillation frequency, column 8, lines 5-13).

It is desirable to obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and controlling oscillation frequency based upon said phase because the start point of the sweep signal can be detected with higher accuracy (column 3, lines 52-53). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the

teaching of Sano et al. with the method of Tuukkanen to provide the advantage as stated in above.

(2) Regarding claim 2:

Tuukkanen further discloses that the method comprising steps of:

successively calculating correlation values, in symbol intervals (the training parts recur after every Nth sample wherein Nth sample can be equal to one symbol, column 7, lines 33-34), between a receive signal that prevailed one frame earlier and a currently prevailing receive signal (by using two training parts, it is already possible to find out the correct timing amount and the frequency errors, a better final result can be obtained by using several training parts, column 8, lines 35-36); and

adopting a peak correlation value, at which power of the correlation values peak, as said correlation value of said identical time profile portion (for determination the maximum point, the absolute value of the summing results is first obtained in block 406, and in a comparison block 407, the absolute value is compared with a set threshold value, in the threshold value setting block 403, the strength of the received signal is estimated, when an energy maximum point is detected, the argument of the greatest value of the values determined in the energy determination window is selected in block 409, producing an estimate for the correct timing, column 7, line 55-column 8, line 11).

(3) Regarding claim 3:

Tuukkanen further discloses wherein symbols having said identical time profile (training parts) are embedded in identical portions of each of the frames (since the training parts recurs after every Nth sample, it is inherent that the training parts can be

embedded in identical portion of each of the frame when 1 frame contains a multiple of Nth samples, column 7, lines 33-34).

(4) Regarding claim 4:

Tuukkanen discloses a method in an OFDM wireless system comprising steps of:

receiving, from the transmitting device, frames in which n-number of first to nth symbols having prescribed time profiles (training parts) have been embedded (it is known that the received OFDM signal have a training parts recur after every Nth sample, column 7, lines 31-34);

calculating and summing correlation values of n sets of corresponding time profile portions in neighboring frames of a receive signal (the delay block 401 in figure 4 delayed the OFDM signal for N samples wherein N can be the length of 1 frame, column 7, lines 45-47);

obtaining the phase of said sum value as a frequency deviation between the transmitting device and the receiving device (in the multiplier 402, the OFDM signal and the complex conjugate of the delayed OFDM signal are multiplied with each other, and N subsequent multiplication results are summed up in a summing block 45 in figure 22, the result is a correlation function, from which at the next stage, maximum and minimum points are found and the phase angle is determined, column 7, lines 49-55); and

Tuukkanen fails controlling oscillation frequency based upon said phase.

However, Sano et al. discloses controlling oscillation frequency based upon said phase (when the oscillation frequency control signal generator 128 in figure 22 detects when the correlation value is obtained is leading relative to a reference phase which the

receiver has, the local oscillator 130 is controlled so as to decrease the oscillation frequency , while when the point of sample where a peak correlation value is obtained is lagging relative to the reference phase of the receiver, it is controlled to increase the oscillation frequency, column 8, lines 5-13).

It is desirable to control oscillation frequency based upon said phase because the start point of the sweep signal can be detected with higher accuracy (column 3, lines 52-53). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the teaching of Sano et al. with the method of Tuukkanen to provide the advantage as stated in above.

(5) Regarding claim 5:

Tuukkanen further discloses wherein said n-number of first to nth symbols are embedded in identical portions of each of the frames (since the training parts recurs after every Nth sample, it is inherent that the training parts can be embedded in identical portion of each of the frame when 1 frame contains a multiple of Nth samples, column 7, lines 33-34).

(6) Regarding claim 6:

Tuukkanen further discloses that wherein said n-number of first to nth symbols are embedded equidistantly in each of the frames (it is known that the received OFDM signal have a training parts recur after every Nth sample, column 7, lines 31-34).

(7) Regarding claim 7:

Tuukkanen further discloses that steps of:

successively calculating correlation values, in symbol intervals, between a receive signal that prevailed one frame earlier and a currently prevailing receive signal (the delay block 401 in figure 4 delayed the OFDM signal for N samples wherein N samples can be the length of 1 frame, in the multiplier 402, the OFDM signal and the complex conjugate of the delayed OFDM signal are multiplied with each other, column 7, lines 45-55); and

summing corresponding correlation values at cycles of 1/n frame, obtaining a peak correlation value at which power peaks, and adopting this peak sum value as said sum value (N subsequent multiplication results are summed up in a summing block 405, the result is a correlation function, from which at the next stage, maximum and minimum points are found and the phase angle is determined, for determination the maximum point, the absolute value of the summing results is first obtained in block 406, and in a comparison block 407, the absolute value is compared with a set threshold value, in the threshold value setting block 403, the strength of the received signal is estimated, when an energy maximum point is detected, the argument of the greatest value of the values determined in the energy determination window is selected in block 409, producing an estimate for the correct timing, column 7, line 49-column 8, line 11).

(8) Regarding claim 13:

Tuukkanen discloses an apparatus comprising:

a receiving unit for receiving frames in which symbols having identical time profiles have been embedded (the synchronizer ML as shown in figure 4 receives

OFDM signal with known training parts recur after every Nth samples, column 7, lines 28-34);

a correlation arithmetic unit for calculating a correlation value between the identical time profile portions in neighboring frames of a receive signal (refer to figure 4, the multiplier 402 and summing block 405 correlates the received OFDM signal and the delayed (delayed for N sample wherein N samples can be the length of 1 frame) received OFDM signal, column 7, lines 45-55);

a phase detector (determination of phase angle 410 in figure 4) for obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device (the phase angle of the correlation function is determined in a phase angle setting block 410, column 8, lines 15-17); and

Tuukkanen fails to disclose an oscillation frequency controller for controlling oscillation frequency based upon said phase.

However, Sano et al. disclose an oscillation frequency controller for controlling oscillation frequency based upon said phase (the oscillation frequency control signal generator 128 in figure 22 take the correlation value from the sweep correlation calculation unit 127 and detect the phase difference between the receiver and the transmitter, column 8, lines 5-20, when the oscillation frequency control signal generator 128 in figure 22 detects when the correlation value is obtained is leading relative to a reference phase which the receiver has, the local oscillator 130 is controlled so as to decrease the oscillation frequency , while when the point of sample where a peak

correlation value is obtained is lagging relative to the reference phase of the receiver, it is controlled to increase the oscillation frequency, column 8, lines 5-13).

It is desirable to obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and controlling oscillation frequency based upon said phase because the start point of the sweep signal can be detected with higher accuracy (column 3, lines 52-53). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the teaching of Sano et al. with the method of Tuukkanen to provide the advantage as stated in above.

(9) Regarding claim 14:

Tuukkanen further discloses an apparatus wherein said correlation arithmetic unit has:

means for successively calculating correlation values, in symbol intervals (the training parts recur after every Nth sample wherein Nth sample can be equal to one symbol, column 7, lines 33-34), between a receive signal that prevailed one frame earlier and a currently prevailing receive signal (refer to figure 4, in the multiplier 402, the OFDM signal and the complex conjugate of the delayed OFDM signal (delayed for N sample wherein N samples can be the length of 1 frame), are multiplied with each other and N subsequent multiplication results are summed up in summing block 405, column 7, lines 45-55); and

means for adopting a peak correlation value, at which correlation power peaks, as said correlation value of said identical time profile portion (for determination the

maximum point, the absolute value of the summing results is first obtained in block 406, and in a comparison block 407, the absolute value is compared with a set threshold value, in the threshold value setting block 403, the strength of the received signal is estimated, when an energy maximum point is detected, the argument of the greatest value of the values determined in the energy determination window is selected in block 409, producing an estimate for the correct timing, column 7, line 49-column 8, line 11).

(10) Regarding claim 15:

Tuukkanen discloses an apparatus comprising:

a receiving unit for receiving frames in which n-number of first to nth symbols having prescribed time profiles have been embedded (the synchronizer ML as shown in figure 4 receives OFDM signal with known training parts recur after every Nth samples, column 7, lines 28-34);

a correlation arithmetic unit for calculating and summing correlation values of n sets of corresponding time profile portions in neighboring frames of a receive signal (refer to figure 4, the multiplier 402 and summing block 405 correlates the received OFDM signal and the delayed (delayed for N sample wherein N samples can be the length of 1 frame) received OFDM signal, column 7, lines 45-55);

a phase detector (determination of phase angle 410 in figure 4) for obtaining the phase of said sum value as a frequency deviation between the transmitting device and the receiving device (the phase angle of the correlation function is determined in a phase angle setting block 410, column 8, lines 15-17); and

Tuukkanen fails to disclose an oscillation frequency controller for controlling oscillation frequency based upon said phase.

However, Sano et al. disclose an oscillation frequency controller for controlling oscillation frequency based upon said phase (the oscillation frequency control signal generator 128 in figure 22 take the correlation value from the sweep correlation calculation unit 127 and detect the phase difference between the receiver and the transmitter, column 8, lines 5-20, when the oscillation frequency control signal generator 128 in figure 22 detects when the correlation value is obtained is leading relative to a reference phase which the receiver has, the local oscillator 130 is controlled so as to decrease the oscillation frequency , while when the point of sample where a peak correlation value is obtained is lagging relative to the reference phase of the receiver, it is controlled to increase the oscillation frequency, column 8, lines 5-13).

It is desirable to obtaining the phase of said correlation value as a frequency deviation between the transmitting device and the receiving device; and controlling oscillation frequency based upon said phase because the start point of the sweep signal can be detected with higher accuracy (column 3, lines 52-53). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the teaching of Sano et al. with the method of Tuukkanen to provide the advantage as stated in above.

(11) Regarding claim 16:

Tuukkanen further discloses an apparatus wherein said correlation arithmetic unit has:

means for successively calculating correlation values, in symbol intervals (the training parts recur after every Nth sample wherein Nth sample can be equal to one symbol, column 7, lines 33-34), between a receive signal that prevailed one frame earlier and a currently prevailing receive signal in a case where n-number of first to nth symbols have been embedded equidistantly in each of the frames (refer to figure 4, in the multiplier 402, the OFDM signal and the complex conjugate of the delayed OFDM signal (delayed for N sample wherein N samples can be the length of 1 frame), are multiplied with each other and N subsequent multiplication results are summed up in summing block 405, column 7, lines 45-55);

a summing unit for summing corresponding correlation values at cycles of 1/n frame (N subsequent multiplication results are summed up in a summing block 405, the result is a correlation function, column 7, lines 49-55) (it is not explicitly described that the summing unit sum the corresponding correlation values at cycles of 1/n frame, it is inherent that when the training parts recur after Nth sample in the frame, the summing unit will be summing the corresponding correlation values at cycles of 1/N frame); and

means for adopting a sum value at which power peaks as said sum value (maximum and minimum points are found and the phase angle is determined, for determination the maximum point, the absolute value of the summing results is first obtained in block 406, and in a comparison block 407, the absolute value is compared with a set threshold value, in the threshold value setting block 403, the strength of the received signal is estimated, when an energy maximum point is detected, the argument of the greatest value of the values determined in the energy determination window is

selected in block 409, producing an estimate for the correct timing, column 7, line 55-column 8, line 11).

Allowable Subject Matter

4. Claims 8-12 and 17-20 allowed.

5. The following is a statement of reasons for the indication of allowable subject matter:

(1) Regarding claims 8-12 and 17-20:

The present invention describes the frequency synchronization method and apparatus involving a first correlation value between a time profile between a time profile in a guard interval and a time profile of a symbol portion that has been copied to a guard interval obtaining the phase of said first correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase; and when a predetermined condition holds, calculating a second correlation value between identical time profile portions in mutually adjacent frames of a receiving signal, obtaining the phase of said second correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase. The closest prior art Tuukkanen (US 6,584,164 B1) discloses a similar system which synchronizes the oscillating frequency between the an OFDM transmitter and receiver by using training parts in the received OFDM signal. However, Tuukkanen fails to disclose calculation of a first correlation value between a time profile between a time

profile in a guard interval and a time profile of a symbol portion that has been copied to a guard interval obtaining the phase of said first correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase; and when a predetermined condition holds, calculating a second correlation value between identical time profile portions in mutually adjacent frames of a receiving signal, obtaining the phase of said second correlation value as a frequency deviation between the transmitting device and the receiving device, and controlling oscillation frequency based upon said phase. The distinct features have been added to the independent claims 10-33, therefore, rendering them allowable.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Isaksson et al. (US6,181,714 B1) discloses a multi-carrier transmission systems. Nomura (US 6,731,702 B1) discloses a null symbol position detection method, null symbol position detecting apparatus, and receiver. Eberlein et al. (US 6,993,084 B1) discloses a coarse frequency synchronization in multicarrier systems. Lee (US 6,373,861 B1) discloses a frequency synchronizing device for OFDM/CDMA system.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Siu M. Lee whose telephone number is (571) 270-1083.

The examiner can normally be reached on Mon-Fri, 7:30-4:00 with every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Siu M. Lee
3/30/2007

CHIEH M. FAN
SUPERVISORY PATENT EXAMINER